



A Carbon180 Fact Sheet

Direct Air Capture

Direct air capture (DAC) is a technology that removes carbon dioxide from the atmosphere. The captured CO₂ is permanently stored underground or used in the production of commercial products like building materials and fuels. Meeting global climate goals will require both reducing emissions and removing them through carbon removal technologies like DAC.



Photo credit: Carbon Engineering

Where in the world is DAC?

DAC is not entirely new. Similar systems have been installed in submarines and space applications for decades – it would be impossible to breathe in these closed environments without them. Over the past several years, progress on the large-scale versions has moved quickly. Today, there are three leading commercial development efforts.

1.

Carbon Engineering
Canada

Pilot plant removes 1 metric ton/day
Engineering world's largest plant in the US that will capture 1 million metric tons/year

2.

Climeworks
Switzerland

Runs world's first net-negative power plant
Currently operates 15 DAC facilities across Europe, and sells both captured CO₂ and their carbon removal service

3.

Global Thermostat
New York

Currently operating a 4000 metric ton/year removal plant in Alabama

ADVANTAGES OF DAC



Economics: DAC has the potential to be a global business by mid-century, and at full scale could create at least 300,000 new jobs in construction, engineering, and manufacturing.



Scalable: The modular design of many DAC plants means these facilities can be scaled up while keeping a small physical footprint compared to other forms of carbon removal.



Storage: Entire sectors can move from net-zero to net-negative by storing the CO₂ from DAC in underground layers of rocks (dedicated geologic storage).



The Hellisheidi geothermal power plant in Iceland provides the renewable energy needed to power the Climeworks DAC machines and facilitate the permanent storage of CO₂ through a process called mineralization. DAC facilities like this may be able to store 0.5–5 billion metric tons of CO₂ per year by the year 2050. Photo credit: Climeworks



Photo credit: Climeworks

Current policy support for DAC

Policy support for DAC is growing rapidly. One of the most pressing needs is a robust federal research, development, demonstration, and deployment (RDD&D) program. Fiscal year (FY) 2020 appropriations took steps to develop this program with **\$68 million** appropriated for RDD&D related to negative emissions technologies with specific carve outs for DAC, and FY2021 appropriations bills have even higher levels of funding. Additionally, there are bills in the House and Senate to update the Department of Energy's Office of Fossil Energy to establish the first-ever dedicated federal carbon removal RDD&D program.

COSTS & OPPORTUNITY

Cost estimates for DAC are currently between **\$200 to \$600 per ton**, though a recent study suggested the cost of future plants could drop below **\$100 per ton**. Meanwhile, the US total available market for using CO₂ exceeds **\$1 trillion**. Paired with regulatory incentives, these growing markets can help drive down DAC costs further.

Previous support includes the FUTURE Act, signed into law in 2018, which updated an existing tax credit to include DAC for the first time. As a result, a DAC project can now receive a tax credit worth **\$35–\$50 per ton** of captured CO₂, depending on how it is used. California also allowed DAC combined with secure geologic storage to access their low carbon fuel standard market – currently the most valuable carbon incentive globally at **\$180 per ton**.

There are currently several other bills in Congress with provisions that would establish competitive DAC prizes, ensure cross-agency coordination on carbon removal, and much more.

FURTHER READING

National Academies of Sciences, Engineering, and Medicine (2018). *Negative Emissions Technologies and Reliable Sequestration: A Research Agenda*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25259>

Rhodium Group (2019). *Capturing Leadership Policies for the US to Advance Direct Air Capture Technology*. New York, NY: Rhodium Group, LLC.